ENERGY EFFICIENCY

• EVERYONE'S GUIDE TO •

saving energy *in* compressed air

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Why save compressed air?

Compressed air is an essential resource; it is often referred to as the fourth utility after gas, electricity and water. The common misconception is that it is free. Air is free – until it's compressed. There are two main reasons for reducing the amount of compressed air you use:

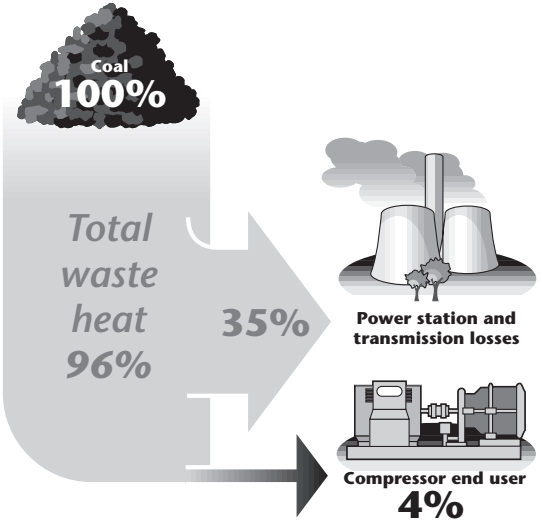
- **It is expensive**
- **To produce it requires a lot of energy (usually electricity)**

There are many applications where compressed air for safety reasons is the only suitable method. However, more often than not, we use it just because it's there and it's convenient.

The costs and effects on the environment are invisible, so no-one is aware of compressed air's real impact.

The real cost of compressed air

Primary natural resources, such as coal, gas or oil, are used to generate electricity. This secondary energy source is then used to produce compressed air, which is therefore a tertiary source of energy. This makes it very expensive, about ten times the cost of electricity. From the diagram below you can see just how much natural resource such as coal, is required to produce the air.



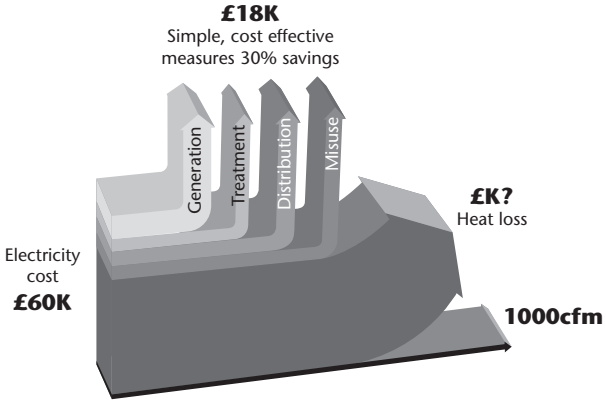
Only 4% of the coal mined from the ground is usefully converted into compressed air, the rest is lost as waste heat at the power station, along transmission lines, and finally in the compressor itself.

Compressors have to be kept cool for them to compress air efficiently. For every 100 units of electricity which go into the compressor, only 10 units of compressed air are available for use. The rest is rejected as waste heat.

You can effectively cut the cost of compressed air if you recover this waste heat from the compressor, e.g. by ducting the warm air to heat nearby areas of the plant during winter.

Since compressors produce heat, the compressor house is usually much warmer than the outside temperature. Cold air is already denser than warm air and requires less energy to compress it, so where practical, position the air inlet to take air from outside.

The diagram below shows where the energy goes and the



The importance of maintenance

opportunities for reducing consumption.
Most people think that the largest cost is the initial purchase price, then the running costs are mostly maintenance. **NOT TRUE!** Over a 10 year period, 75% of the total cost is the

energy – i.e. the electricity.
If maintenance is neglected, electricity use increases. Missing or postponing a maintenance check does not save money, e.g. when a filter is clogged, extra power is needed to overcome the obstruction, so the generating pressure is increased. This uses more energy and costs money.

The most important issue for production is that the compressed air system is **RELIABLE**. The supply will be more reliable with regular maintenance.

What can I do – and how can I get started?

Every compressed air system is different, but they can all be improved. Remember to look at the **WHOLE** system, pipework, filters, hoses - not just the compressors themselves.

a) calculate how much your compressed air system costs each year

You can get an approximate running cost in terms of electricity for a compressor each year, using the calculation below.

Size of motor (kW)	×	**cost of electricity per unit**	×	**running hours per day**	×	**days**	×	**weeks**

Example: A factory runs a 100kW compressor 24 hours a day, 5.5 days a week, all year round. It pays 5p per unit (kilowatt hour) for electricity.

Cost = 100 × 0.05 × 24 × 5.5 × 52
= £34,320 a year!

This figure is only a guideline, since it assumes only full load running, and it also does not take account of actual motor efficiency.

(b) Find the leaks

The typical leak rate on a site can be up to 40%. That's a lot of compressed air wasted, so the compressor will have to work harder and longer.

- **Does your site have a leak repair and reporting programme? If not, suggest it.**
- **Leakage survey – identify all leaks on a site drawing as well as tagging**
- **Estimate the leakage rate at your site by carrying out a no-load test (details in GPG 126 page 5)**

- **Listen for leaks at flange joints, pipe connections and pressure regulators**
- **Check air compressors at the weekend or when there is no production**
- **Hire or purchase ultrasonic leak detection equipment to find leaks. Large leaks cannot necessarily be heard**
- **Check that redundant pipework is isolated from the rest of the system**
- **Check that manual condensate drain traps are not jammed open, and therefore acting as a source of leaks**

Hole diameter	Air leakage at 7 barg		Power required to compress air being wasted	Annual cost of leak	
				48 h/wk	120 h/wk
mm	l/s	cfm	kW	£	£
0.4 (pin head)	0.2	0.4	0.1	12	30
1.6 (match head)	3.1	6.2	1.0	120	300
3.0	11.0	22.0	3.5	420	1,050

c) Misuse of compressed air

Quite often people use compressed air because it's there, but it should never be used for cleaning down work benches or floors. There are cheaper and more environmentally-friendly methods.

Examples:

- **Cooling products – use fans instead or water cooling if suitable.**
- **Ventilation - if your workplace is too hot, tell your team leader.**
- **Blowing swarf off machinery and work benches.**
- **Agitation/bubbling of liquids.**
- **Drying.**
- **Moving products on and off conveyors.**

Take a walk round - where compressed air is used, is there another way of doing the job?

d) Switch off when not needed

Compressor installations are often left on overnight, even when there is no production. This is very wasteful because

- **power is being used to feed leaks;**
- **even when compressors are idling, they can still draw 40% of their full load current.**

So find out if the compressors can be switched off when they're not needed. If the compressors are running fewer hours, this will also reduce maintenance costs.

e) Controls

Compressors switch on and off as the pressure demand varies. This 'cycling' is very wasteful in terms of energy.

Fitting timers and control systems can minimise the on load and off load patterns and save substantial amounts of electricity.

Teamwork to solve problems and generate ideas

Everyone should be concerned about the amount of natural resources we use, and a lot of the wasteful practices can be resolved by teamwork.

All the suggestions made here are common sense, everyone can contribute, you don't have to be a technical specialist.

Who can you involve?

- **Production need a reliable source of compressed air.**
- **Quality assurance needs to be sure the air is clean.**
- **Health & safety – misuse of high pressure at the point of use can be dangerous and wasteful.**
- **Managers are concerned about cost and the profitability of the organisation.**

Suggest a working group, perhaps as part of a quality or environmental initiative, to look at compressed air.

Action plan

Encourage your colleagues and supervisor to carry out a review of the whole compressed air system.

Action checklist

- Estimate annual running costs.
- Set up a leak reporting and repair system and check the pipework for leaks, distortion and corrosion.
- Look for misuses, such as cleaning with compressed air blasts.
- Find out how many hours per week the whole system is pressurised - can this be reduced?
- Check maintenance programme for filter changes.
- Investigate whether the waste heat from the compressor(s) can be used elsewhere for heating or drying.
- Check that manual condensate drain traps are not jammed open.
- Contact the Environment and Energy Helpline for more free technical advice and information.

Finding out more

Environment and Energy Helpline

0800 585794

Call us for help on any energy or environment related question, and to order the free publications below:

- ***Compressed Air Essentials* – the full publications list**
- ***Compressing air costs* (Good Practice Guide 126)**
- ***Energy savings in the filtration and drying of compressed air* (Good Practice Guide 216)**
- ***Heat recovery from air compressors* (Good Practice Guide 238)**
- ***Energy savings in the selection, control and maintenance of air compressors* (Good Practice Guide 241)**
- ***Air Lines newsletter* (FL0035)**
- ***Action Agenda for team meetings* (FL0036)**
- ***Compressed air and energy use* (Fuel Efficiency Booklet 4)**

For practical advice on how to reduce your organisation's energy costs, visit our web site:

http://www.energy-efficiency.gov.uk

Other sources of information

The British Compressed Air Society

The Society represents equipment manufacturers and distributors. It runs a Chartered Distributor Scheme. Qualifications and independent technical advice are available.

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Fax: 020 7580 4420
Web site: www.instenergy.org.uk
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Other guides in the series:

- *Saving energy and reducing waste*
- *Maintenance*
- *Boilers*

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